Section 4.0 Benefits of Sediment Control BMPs

The use of sediment control BMPs as an alternative or in addition to sedimentation ponds for controlling sediment and erosion in arid and semiarid watersheds, has numerous environmental and enforcement benefits that are not realized when sediment control is designed around the implementation of sedimentation ponds alone. This section presents the distinct advantages provided by implementation of a fully integrated, site-specific, and appropriate sediment control BMP system.

4.1 Environmental Benefits

The capabilities of sediment control BMP systems that are designed to address site-specific conditions can expedite improved protection and rehabilitation of local natural and environmental resources that are potentially impacted by mining and reclamation activities. The fact that BMP Systems are specifically designed to minimize disruption of fluvial stability, minimize mine related disturbances, foster sustainable sediment equilibrium, and minimize potential for catastrophic release events, makes them appropriate for erosion and sedimentation control at arid and semiarid mine sites.

4.1.1 Source Control

Minimizing erosion and sedimentation problems and treating surface runoff at the source are distinct advantages that BMP systems have over sedimentation pond treatment technology. Sediment and erosion control BMP Systems are capable of controlling sediment at its source, preventing erosion across disturbed areas, and preventing impacts to adjacent undisturbed areas. Treating erosion and sedimentation at or near the source allows surface water runoff to seek sediment-content equilibrium throughout the entire watershed. This equilibrium results in the creation of an acceptable, system-wide dynamic balance between flow volumes and sediment transport. Source control is needed to achieve and maintain this balance between sediment

loading from surface water runoff and long-term erosion control after mining and reclamation activities have been completed. To this end, avoiding the construction and subsequent removal of sedimentation ponds for sediment treatment purposes and establishing a viable BMP system is paramount to hydrologic system maintenance and rehabilitation.

4.1.2 Minimizes Disturbance to the Hydrologic Balance

Congressionally mandated regulatory goals require protection of the waters of the United States and the avoidance or minimization of disruption to the hydrologic balance where surface coal mining and reclamation activities are conducted. With the implementation of alternative or additional BMPs, erosion and sediment control is focused on the source which allows surface water that does not infiltrate to discharge from mining or non-process areas in a controlled fashion. Sediment levels in the runoff are allowed to fluctuate with the erosion potential conditions in the watershed, and are not artificially reduced by large in-channel structures (i.e., sedimentation ponds). This approach to the control and release of surface drainage adjusts the hydrologic system gradually, allowing it to adjust slowly over time. This slow adjustment provides system stability and enables the components of the watershed to effectively interact and maintain the hydrologic balance. By allowing natural sediment flow through the system, the fluvial balance in the watershed benefits through the establishment of natural erosion processes that will prevail after mining and reclamation activities have ceased.

Exposing the down-drainage system to sudden flushes of drainage following removal of flow restricting or constricting structures is avoided. Sudden flood events can be very disruptive to channel morphology. Seasoning channels with a range of flows over a period of time, and avoiding flash flood events or extended periods of water unavailability, facilitates reclamation. Problem areas associated with various flow volumes can be identified and corrected. Channel and hydrologic rehabilitation is nurtured for a period of several years under realistic and natural post-mining flow conditions. The net result can be improved and reclaimed areas with increased hydrologic stability and nominal disruption to undisturbed lands adjacent to or downstream from the affected areas.

4.1.3 Maintains Natural Sediment Yield

Surface water drainage with sediment concentrations approximating background levels avoids the accelerated erosion that is associated with and frequently occurs immediately downstream from points where low sediment content waters are discharged (Western Coal Mining Work Group, 1999a). Accelerated erosion is disruptive to the existing down-drainage hydrologic balance. In its more dramatic visible forms, accelerated erosion manifests itself in head-cutting, increased scouring (channel degradation), mass caving, and bank failures in receiving channels. In severe cases, this type of erosion may affect tributaries throughout a portion of or an entire watershed. Establishing sediment yields that approximate natural levels for the prevailing environmental and hydrologic conditions increases the rehabilitation of watershed characteristics and provides for increased channel stability.

Water released from sedimentation ponds contains low concentrations of sediment and usually occurs in flow volumes significantly less than flow volumes that occurred prior to mining. When discharges from a sedimentation pond occur, the essentially sediment-free water begins to immediately entrain sediment from the fluvial system below the pond. The small discharge volumes typically do not have the capacity to transport large amounts of sediment immediately below the pond, but the discharge can have the potential to accelerate erosion and degrade the stream channel immediately downstream from the sedimentation pond (Western Coal Mining Work Group, 1999a). Due to the cumulative nature of this erosion, it can become visibly apparent during the Phase II reclamation liability and bonding period (i.e., 10+ years).

An additional receiving channel impact may occur due to the alteration of sediment concentration. A lowering or a raising of sediment concentration in drainage from the non-process area watershed can trigger degradation or aggradation of the receiving channel, respectively. Degradation is possible when sediment concentration is lowered and additional sediment is entrained by the flow event. Conversely, if drainage from the undisturbed watersheds below the sedimentation pond is higher in sediment concentration, the reduction in lower sediment concentration flow from the non-process area watershed may trigger aggradation

of the receiving channel. This decrease in entrainment capacity and flow can result in increased sediment.

Implementation of sediment control BMPs in addition, or as an alternative, to sedimentation ponds, provides an advantage in allowing drainage to entrain and carry a sediment load that approaches its energy capacity to do so and that is not artificially adjusted by an in-stream structure (sedimentation pond) before being released. The result is the prevention of severe erosion and instability problems directly downstream.

4.1.4 Minimizes Surface Disturbance

The appropriate application of alternative sediment and erosion control BMPs can avoid a significant amount of unnecessary surface disturbance on western mine lands. The amount of land that must be disturbed for construction of sedimentation ponds varies based on site specific environmental conditions. For example, the number of acres of surface land disturbance resulting from the use of sedimentation ponds at four coal mine sites in the arid western coal region are presented in Table 3a, Section 3.2.1. The four mine operations vary significantly in their use of ponds, from 14 to 149 total ponds that disturb from 36 to 540 acres. The use of BMP systems would avoid the disturbance of these additional acres.

Under Wyoming's Guideline No. 15, the Jim Bridger Mine uses alternative sediment control BMPs (e.g., berms, diversion ditches, and small catchments) to manage drainage from reclaimed areas and has only disturbed 3.9 acres (Western Coal Mining Work Group, 1999b). The Jim Bridger mine estimates that an additional 200 acres would be disturbed if sedimentation ponds were used to manage drainage at this site (Western Coal Mining Work Group, 1999a). The reduction in surface disturbance that may be expected by implementation of sediment control BMPs as an alternative to sedimentation ponds is significant.

4.1.5 Encourages Vegetation

A BMP system approach to erosion and sediment control maximizes the land's ability to harvest or use precipitation which is key to the success of vegetation in the arid and semiarid western United States. Sediment control has historically focused primarily on the capture of surface water runoff in sedimentation ponds located on the bottom periphery of the disturbed area. Surface water runoff captured by sedimentation ponds in the arid and semiarid regions is typically allowed to evaporate, and is not made available for vegetative growth or soil conditioning. Sediment control BMP plans encourage the infiltration and retention of precipitation in the soil where it benefits microbial activity and plant growth. These BMP plans are designed to maximize the availability of limited precipitation for improving soil and enhancing vegetation and are critical to the growth and establishment of vegetation and the development of plant communities. Even small increases in plant cover and associated root mass can have significant impacts on the stability of reclamation surfaces by reducing flow velocity, increasing soil cohesiveness, and promoting biological diversity.

4.1.6 Improves Soil and Promotes Soil Conservation

The characteristics of soil are key to successful reclamation. Water management and soil improvement practices that are inherent to sediment control BMPs can effectively improve soil moisture availability. Soil characteristics that are critical to the growth and establishment of vegetation can be readily influenced by these BMPs both temporarily and permanently. BMP systems promote water infiltration and availability, which increase incorporation of organic materials capable of improving soil structure, nutrient retention and availability, water infiltration and harvesting, and long-term plant production and diversity.

Western topsoils are generally poorly developed and tend to be characteristically poor in nutrients (Western Coal Mining Work Group, 1999a). Ensuring that this valuable resource is conserved and even improved during reclamation is an important concern. Implementation of appropriate sediment control BMPs can be expected to conserve and protect this resource by

controlling overland flow and its associated erosion force, limiting slope lengths, increasing surface roughness, harvesting precipitation, increasing moisture content, promoting vegetation diversity, increasing organic matter, improving soil texture, and fostering soil formation processes. These factors combine to result in improvements to soil characteristics that promote and encourage stability, soil biota content, cohesiveness, and plant growth. Increases in soil biota and above ground vegetation in turn promote soil formation and stability.

4.1.7 Addresses Site-Specific Environmental Conditions

The design of sedimentation control plans incorporating appropriate BMPs allows for sediment control on a site-specific basis, according to a site's environmental conditions and requirements. Implementation of BMPs that are designed to address specific sedimentation and erosion concerns, background sediment levels, and hydrologic conditions of a particular site, allows more appropriate, performance-based sediment criteria to be developed prior to issuance of permits. Implementation of site-specific, comprehensive sediment and erosion control BMP plans also allows for consideration of the long-term effects of mining and reclamation operations and avoids the shock that can be experienced by these watersheds from the implementation and subsequent removal of water impounding structures (i.e., sedimentation ponds).

4.1.8 Stabilizes Landforms

Topography plays a key role in the long-term surface stability of arid and semiarid non-process areas. The primary goal in designing, constructing, and implementing sediment control BMPs that will determine post-mining topography is to achieve a stable landform. An appropriate and natural topography created by implementation of BMP plans that consider site-specific drainage patterns is essential to minimizing erosion rates and encouraging the growth of vegetation.

BMPs that are implemented to provide appropriate topography increase channel stability, improve soil moisture availability, foster the creation of shallow perched water tables, encourage

increased infiltration of precipitation and drainage into ground water resources and decrease soil erosion. All of these functions allow the establishment of vegetation within the reconstructed channels where little or no vegetation existed prior to mining and reclamation operations.

4.1.9 Minimizes Disruptions to Flow Regime and Evapotranspiration Losses

Sedimentation ponds have significant potential for removing runoff from the hydrologic system, and precluding potential down-drainage uses. With the implementation of alternative sediment control BMPs, drainage is allowed to flow relatively unimpeded. As a result of the appropriate implementation of these systems, impacts to downstream water users and to intermittent or perennial water resources, are minimized or avoided. In addition, the long-term flow pattern is established early in the reclamation process and sudden impacts to stream morphology and flow regime experienced after the removal of a sedimentation pond at Phase II bond release can be prevented. Disruption of the prevailing hydrologic balance in arid and semiarid regions can be expected to be much greater when the use of sedimentation ponds is predominant, than when BMPs are used to simulate pre-mining, undisturbed conditions.

BMP systems also avoid the unnecessary impounding of water and associated evaporation losses. Losses from ponds can be significant in the arid and semiarid west where evaporation rates are characteristically much higher than the annual precipitation (Western Coal Mining Work Group, 1999a). Implementation of sediment control BMP plans also serves to increase the availability of surface and ground water, because water loss is avoided and runoff is allowed to flow naturally and recharge local downstream resources.

4.2 Implementation and Enforcement Benefits

4.2.1 Implements Existing Requirements

The Surface Mining Control and Reclamation Act already institutes specific requirements for surface coal mining and reclamation operations to achieve acceptable reclamation standards. These performance standards include successful revegetation, approved post-mining land use, stabilizing and protecting all surface areas to effectively control erosion, and minimizing disturbance to the prevailing hydrologic balance while taking into consideration the physical, climatological, and other characteristics of the site. SMCRA's performance standards require establishment of an effective, permanent vegetative cover that is at least equal in extent to the natural vegetation or to that necessary to achieve the approved post-mining land use.

Implementation of a sediment and erosion control BMP plan designed to address site-specific sedimentation issues incorporates and complies with all requirements under SMCRA, without precluding consideration for local hydrologic balance.

4.2.2 Improves Monitoring and Inspection Capability

Under the existing effluent guidelines, a mine is required to monitor point source discharges to demonstrate that Settleable Solids (SS) are equal to or less than 0.5 mL/L when released from reclaimed areas. To meet Phase II bond release requirements, the inflow into sedimentation ponds must be equal to or better than background and meet all applicable federal, state, local and tribal laws and regulatory requirements. When these requirements are met, the operator is eligible to apply for a Phase II bond release for the reclaimed area and terminate the existing guideline monitoring obligation. With the implementation of alternative or additional sediment control BMPs, inspection and enforcement compliance monitoring would be improved dramatically. It would no longer be necessary to wait for a precipitation event to obtain samples to determine compliance. Alternative sediment control BMPs would allow Phase II bond release inspection and compliance evaluations to proceed independently of the season of the year or

storm events and on a more frequent basis. The BMP approach uses the inspection of BMP design, construction, maintenance and operation to demonstrate compliance.

4.2.3 Provides Control and Treatment Flexibility

Sediment control BMP plans have been and are being successfully implemented. These BMP plans are highly adaptable to nearly all erosion and sedimentation control situations. This means that each site's unique and diverse environmental conditions may be considered and addressed through the implementation of site-specific BMP plans that can be designed and adjusted to achieve a variety of prioritized goals best suited to the needs of a particular location.